Technology Transfer in Agriculture: Social and Economic Aspects

by Dr Shamsul Alam Mohan

TECHNOLOGY is means to help production activities, augment outputs and make possible management of resources and products. Some technologies are in vogue over as longer period of time while some are changing or replaced wholly or partially by improved versions towards better use of resources or outputs. Technology is a dynamic concept thriving with betterment of technique(s) (technique is a single production method), and embodies simple technique to composite ones. Technological change simply refers to advances in scientific knowledge.

Access to and control of technologies needs investment by the producer. Decision to invest requires desire to risk taking, ability and technical know-how. Because of lack of fund, general inertia of habit nation with the existing techniques of production, farmers producers usually are not inclined to quick change in terms of adopting new technologies). Therefore, technology transfer and adoption in the farming practice encounter formidable problems in the developing countries.

Agricultural sector is yet the mainstay of Bangladesh economy. So, technological transformation of the agricultural sector is a necessary pre-requisite for modernization of the sector to support sustained and increased production. But there is a general lag in adoption of improved technologies owing to lack of balanced flow of information, lack of complementary inputs/resources and lower level of formal education to perceive the potentiality of change by the decision making farmers.

Agricultural Technology

Agricultural technologies can be group into: *Indigenous technologies and *modern technologies. Indigenous technologies have been or are generated at farm level and by farmers. In the farming community there are innovative farmers who develop or modify indigenous technologies at their own and adapt in farm practices. Modern technologies have been developed largely by improving/refining the indigenous and often imported technologies or varieties by the national research institutes. In Bangladesh, the extension organizations and NGOs are devoted more to technology transfer process than to technology generation. Yield growth has been slower in Bangladesh than in her neighbouring countries indicating lower level of technological adoption and diffusion in farming practices.

Problems of Innovation

Innovation (first practical use of a new, more productive technique) or appropriate technologies require substantial funding for research. Agricultural research institutes are primarily entrusted with the generation/innovation of appropriate technologies in the country. On limited scale, Agricultural Universities are also creating and generating agricultural technologies. A few large NGOs are also involved in technology development and use advance technologies for increasing income for the organizations and farmers. But technological innovation faces multi-dimensional problems which can be summed up as the following:

a) Inadequate funding for building research institutions.

b) Shortages of skilled manpower in the existing research institutes.

c) Management of the research institutes are beset with the problems of inadequate funding, lack of accountability and to an extent, visions.

d) Weak linkages of the research institute with the extension services and NGOs.

e) Often research priorities are not demand-driven of the farming communities.

f) Lack of coordination among the research divisions/departments within the institutes.

g) Lack of coordination among the research institutes which result in duplication of work and wastage of limited resources.

h) Over dependence on donor assistance for research funding. Continuation of research efforts get blocked after withdrawal of donor support.

i) Lack of effective people's representation (private sector) in the management of public research institutes and as a result farmers' stake is often ignored.

j) Lack of cooperation/integration between national, regional and international research institutes.

k) In the liberalized economic system, national institutes are failing to cope up and advance as required in encountering the available cheap technologies penetrating the markets.

l) The emerging issue now-a-days is the penetration of global corporations with biological innovation (hybrid seeds) exerting their market power to drive-out or overwhelm achievements/findings of the local institutes. This may even cause long-term damage of the production potentiality of the resources.

Problem of Adoption

Institutional

Research institutions lack built-in mechanisms to get feedbacks from farmers and technology users.

Poor and weak linkages among the research institutions, Universities and NGOs.

Important post-harvest/processing technologies (process innovations) are lacking to preserve farm produces for a longer period of time to market evenly throughout the year.

Absentee land ownership is on the increase and their lands are mostly under sharecropping or often remain fallow. Both absentee landlords and sharecropping land tenants are less interested in change towards modernizations. Sharecroppers may be less efficient and less open to innovation.

Social

Widespread extortion, collection of tolls, deteriorating law-and-order situation, lack of inspection of goods/commodities/tools/machinery create conditions for market failures which act as disincentives towards adopting new invention(s) for further improvement/augmentation of production and movement of marketables.

Scattered and smallness of holdings act as disincentive for adoption of mechanization and use of mechanical technologies

Technology adopted by few farms, while majority does not adopt, creates problem and lack of security for the early adopters.

Absence of farm paths on the crop fields creates problems for movement of equipment/machineries/trolley to and from and around the fields.

There is always problem in motivation of big and absented landlords.

Large farms have usually diversified sources of income and are eager to invest in capital goods items, if at all, like irrigation equipment, tillers, rice haulers and mechanized boats etc, rather than paying attention to improving crop production practices themselves. This creates demand for foreign capital goods items. Large and rich farmers want to be machinery services providers rather than modern agricultural production managers. Effective demand side of this machinery services comes from small and medium farmers who actually with labour surplus families can afford little to buy such services often on cash payment and virtually create a situation of technological static.

Economic

Adoption of new technologies/practices accrue risk and uncertainly. Biological technologies congenial to increased productivity are also considered risky in terms of likely high yield variation. Complementary relationship in using modern factor inputs (seeds, fertilizer, irrigation, pesticides etc) contributes to the probability of increased risk situation in terms of use and availability of all or any of the inputs in time. Farmers especially small and marginal ones are risk averse and therefore are skeptical of immediate switchover to new innovation.

Also, for many other reasons (variations in resource possessions and access to delivery systems and imperfect markets for inputs and outputs etc), technical change occurs differentially between farm households or farm communities in location and another. All modern factor inputs pass through markets (not farm supplied) and need cash capital to buy which most of the small and medium farmers often cannot readily afford even if they wish to adopt. Therefore, provision of formal farm credit support is an essential ingredient of technological diffusion in the small holder farming context.

Lack of information of new innovations and mature technologies in-time at the farmers level inhibit large scale adoptions.

Adoption and Transfer: What is to be Done?

Research and Extension Linkage: Transfer of technologies essentially requires closer liaison of the research institutes, Universities and the field extension services. New Agricultural Extension Policy (NAEP 1996) has emphasized coordination of extension representatives from the government, non-government organization and representatives from research institutes at the national level through working of National Technical Co-ordination Committee (NTCC) of the Department of Agricultural Extension. Representatives also should be taken from the research departments of the Agricultural Universities and from the NGOs involved in poverty alleviation programmes. This should also be true in forming Agricultural Technical Committees (each covering a number of districts in each agroecological region) of the Extension Department. As an apex institution of the NARS (National Agricultural Research System), BARC should be entrusted with the task of assessment of availability, requirement, evaluation of devising technologies and means of quick transfer of technologies and information.

Database and Information System: Information about input (purchased), output prices, marketing opportunities, changing aggregate demand and supply, every day and weekly weather forecasts etc play important role in farm production decisions. There is a need for central database at the control of Department of Agricultural Extension bearing the responsibility of dissemination of information through various media to the public. Department of Agricultural Extension can take help of the GIS support system (at BARC) for data bases on socio economic information, soil characteristics and for other agro-climatic information according to agroecological regions. How knowledge about product prices and their marketing information influence farmers' decision about adoption of improved technologies need to be investigated (by socioeconomic research). Information about inputs (seeds, irrigation water, fertilizer, machine power etc) and their availability is crucially important for adopting various technologies and enhancing agricultural production.

Communication: The most critical obstacle to succeed in the generation and adoption of new technologies for small-scale producers is the absence of communication and co-operation between the various groups and types of people whose contributions are essential: farmers, scientists, policy makers, extensionist, and others in the private sector. Nowadays, radio and television transmission has a direct bearing on the farmers. These media can be tapped efficiently in spreading information (visual demonstration) on mature technologies particularly of yield-increasing types which have tremendous market demand owing to land-scarcity constraints for pursuing agricultural activities. Bulletins and booklets on specific technologies/methods of production in Bangla could be very useful. Farmers are eager to produce as much as possible on a meagre land resource.

Farm and Field Demonstrations/Trials: Discipline based technology research may prove excellent on station and even in the trial of farmers' field, but seldom gets accepted by the general farmers. This is because while technology is developed it does not take into account the farmers' situations and the farming system as a whole. There should be demonstration farms at each Upazila level under the supervision of Agricultural Extension Department wherein all new varietal releases, practice and new techniques will be exhibited to the farmers. Block Supervisors (now-a-days, should be graduates with comprehensive knowledge) will have close linkage and attachments with these exhibition farms and farmers. This will help on-farm trial, motivation and quick transfer of technologies.

Technology Evaluations and Monitoring: It is to be quantitatively known (by research) whether farmers have sufficient knowledge about the current status of their natural resources, for example, soil fertility status, water quality, soil microbes and bio-mass etc. Degradation of natural resources is often reported (for example, soil erosion, salinity, water logging, declining water table, shortage of micro nutrients, deforestation etc). It needs to be investigated whether farmers have sufficient knowledge about these degradation process and the benefits of adoption of technologies to prevent such degradation process.

Relevant costs and benefits must be known beforehand to quicken the transfer process of any technology. It is obvious and essential that rigorous prior economic appraisals must be conduct before releasing any technology or innovation which is usually not done or inadequately performed, if at all. For doing prior and post economic evaluations and assessing market potentials of any new technology, national research institutes (concerned with agricultural technologies) must have viable Agricultural Economics Divisions, which surprisingly, some of the important national research institutions like Bangladesh Jute Research Institute, Bangladesh Fisheries Research Institute, Bangladesh Institute of Nuclear Agriculture are currently lacking.

Involvement of Public and Private Sectors: There has been a tremendous boom in acquiring high-tech satellite telecommunications and uses of optic fibers in cable and cellular communications with exponential increase in number of users in the country. Uses of mainframe computers and powerful micro and mini computers are expanding exponentially. While there is uses of high-tech appliances in the country, on the other hand, technological penetration in the agricultural production sector has been slow, inadequate and rudimentary. Inspiring farmers towards adoption of any improved practices/technologies should first of all must ensure safe return of the invested capital and secondly early adopters should be supported by specified bank credit/NGO credit.

Emphasis on Farming Systems Research: Farming System is understood as an interwoven mesh of soils, plants, animals, workers, other inputs and environmental influences with the strands held and manipulated by the farmer who, given his preferences and aspirations, attempts to produce outputs from the inputs and technology available to him. It is the farmer's unique understanding of his immediate environment, both natural and socioeconomic, that results in his farming system.

System research which necessitates a thorough understanding of the farmer's multi-enterprise situation and difficulties in multi-enterprise system, system approach ensures probability of success of technologies so developed. Farming system research comprehends farmer's problems in totality. Emphasizing farming system research approach should be the thrust policy of the agricultural research strategy and this is more imperative in a situation where there is enterprise complementarity (eg. straw as feeds for livestock) and competition for alternative uses. There is also conflict of interest and in such a case development of technology for any subsystem (say, crops) may not be acceptable though within the sub-system that ensures higher productivity (one can remember initial non-acceptance of high yielding varieties of IRRI rice owing to, partly, low quality of straw as a feed for livestock herd).

Design of Technologies: Agricultural productions are seasonal and glut the markets during the harvest seasons and prices plunge rapidly at the throw away level for which farmers often fail to achieve economic return or surplus that could be recycled for further investments. Appropriate post harvest technologies improving preservation methods can save farmers from the seasonal low product prices trap. Industrial policy needs to be tilted towards agro processing labour intensive industries as that can increase demand for agricultural products through multifarious mode of uses and increase of shelf-life. Import policy must fulfil this technological change requirement. In designing appropriate technologies and in innovation efforts interest of the different size groups of farms and their requirements have to the looked into.

Market Structure Needs to be Competitive: Preponderance of subsistence motive in farming practices make farmers rigid, risk averse and less thriving. So majority remain non-adopters in case of many technologies not by choice, but by force of circumstance. Farming for markets that is on purely commercial line has not been emerging yet even in the recently enshrined market economy policies (except a few cash crops like cotton and tobacco; jute is a well known cash crop but now-a-days its prime consideration for cultivation is jute-sticks and partly rotational obligation). for ensuring profitability for the farm products, measures should be taken to make markets competitive as farmers can get more share of consumers paid prices. If input and product markets become purely competitive, many of the social and institutional problems would relax gradually and exploitations by a few middlemen would go away.

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Agricultural research institutes, universities and the extension department must review the problems of technology adoption and transfer under the co-ordination of apex body of the NARS and adopt programmes to enhance transfer of agricultural technologies to the farmers' field. There should be greater fund allocation from the revenue sources for core researches in the country. Thrusts should also be given to human resources development and improving standard of education particularly at the higher level.

Forgotten People Struggle to Live on Trickle of Aid and Water

Intensified fighting between the ruling Taliban government and the opposition, coupled with drought, have forced thousands of Afghans to flee their homeland. Many spill into Pakistan, where aid agencies are struggling to cope with the influx. Gemini News Service reports from one refugee camp where the aid is as sparse as the terrain.

Nadeem Yaqub writes from Peshawar

THE humanitarian worker sits on a charpoy a bed woven with ropes surrounded by scores of peering faces and a barren, rugged terrain. A register, megaphone and a cup of green tea rest upon a small table in front of him.

He calls out the name "Gul Bibi" and an Afghan woman in her fifties approaches.

She takes a chit from him and joins a swarm of men and women near a truck parked a few metres away. The women are all wearing burqas an all-covering cloak. When Bibi's turn comes, she is handed two quilts.

She carries them on her head and walks to her tent in the New Shamshatu Camp, 35 kilometres southeast of Peshawar. She passes men building mud houses and walks along lines of jerry cans, buckets and tins guarded by children waiting for a water tanker to arrive.

Bibi is one of thousands of Afghans who have sought refuge in Pakistan during the past two months to escape internal conflict and drought in Afghanistan.

The latest influx is adding to the 1.2 million Afghans already living in some 220 refugee camps in Pakistan, mostly in the North-West Frontier Province.

An average of 40 Afghan families enter Pakistan daily at Torkham border, the main crossing on the 2,200-kilometre long boundary between Pakistan and Afghanistan, according to the United Nations High Commissioner for Refugees (UNHCR).

"So far we have settled 2,737 Afghan refugee families 13,410 individuals in the New Shamshatu Camp," says UNHCR officer Niaz Ahmed.

Officials believe many other refugees do not turn up at camps, but go straight to friends and relatives living in Pakistan's cities and towns, including Peshawar, Quetta and the capital Islamabad.

Monitors from the UNHCR and the Afghan Commissionerate, the government body in Pakistan that oversees refugee camps, report that 40 per cent of new arrivals fled Afghanistan because of the conflict.

Ongoing fighting between the Taliban, the Islamic militia group that controls 95 per cent of Afghanistan, and its political opponents has complicated international aid and driven Afghans from the country. The Taliban, which overthrew the former government of Burhanuddin Rabbani in 1996, is only recognised as Afghanistan's legal government by Pakistan, Saudi Arabia and the United Arab Emirates.

Today, Iran and Pakistan jointly host 2.6 million Afghan refugees including some who fled Afghanistan when the Soviet Union marched into their homeland in 1979 in what became a decade-long occupation.

Some 35 per cent of current refugees left to escape the drought in southern Afghanistan, the most serious in 30 years, which has affected half the country's 20 million people.

Since 1992, some 1.85 million Afghan refugees in Pakistan have returned home. The UNHCR aimed to repatriate around 100,000 refugees through the Commissionerate this year, but so far have only been able to return around 48,000.

When Bibi, a widow, arrived with her three sons and daughter in New Shamshatu Camp, she was given a tarpaulin, a jerry can, 100 kilograms of flour, 12 kilograms of pulses and five kilograms of edible oil, the monthly quota.

Bibi says it is not enough.

"We have nothing, not even enough water to use," she says, adding that she has to fetch twigs to use as fuel for cooking.

Young Khan Shirin, who is in a wheelchair after losing his legs in a landmine accident two years ago, adds: "We are not getting enough food and water, we have no sugar, tea or milk."

He also complains that they have no utensils for cooking or eating.

The UNHCR operates health clinics, water facilities and primary level education programmes in Pakistan's refugee camps, and depends heavily on the World Food Programme for other assistance.

The plight of the fresh refugees is stretching already strained humanitarian efforts at a time when international interest in Afghan refugees is low.

The UNHCR budget for Pakistan's refugee camps this year is $12 million, which provides emergency rations for new arrivals only. "Funding for Afghan refugees has generally declined since the end of the Cold War," notes UNHCR official Roy Herrmann.

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